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# Air pollution slows growth of coral reefs in the Caribbean

**Periods of slow growth** observed in coral reefs in the Caribbean are caused by aerosols in the air from pollution and volcanic activity, recent research suggests. Aerosols cause cooler sea surface temperatures and reduce the amount of sunlight reaching the coral, both of which slow coral growth.

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**Source:** Kwiatkowski, L., Cox, P.M., Economou, T. *et al.* (2013) Caribbean coral growth influenced by anthropogenic aerosol emissions. *Nature Geoscience.* 6: 362–366. Doi:10.1038/ngeo1780

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**Coral reefs** are among the world's most important ecosystems, providing habitats for many marine species and services, such as food and tourist attractions, but they are very sensitive to changes in their environment. Sea surface temperature, the amount of the sun's radiation reaching the coral reef and the availability of calcium and bicarbonate ions in the seawater all significantly affect coral growth and reef ecosystems.

In this study, the researchers analysed changing patterns in coral growth since the 19th century at two sites in the Caribbean. It is possible to identify historical environmental conditions that have affected coral growth by analysing layers of calcium carbonate that have built up as a coral has extended its hard external skeleton throughout its lifetime.

They analysed growth records of the coral *Montastraea faveolata* growing off Belize for the period 1905 to 1998, and *Siderastrea sidereal* growing off Panama for the period 1880 to 1989. These growth patterns were compared with growth predictions from a climate model linking chemical, physical and biological processes of the Earth.

The results suggest that changes in coral growth rates in Belize and Panama are related to the Atlantic Multi-decadal Oscillation (AMO) - periodic fluctuations in sea surface temperatures in the North Atlantic that result in cool and warm periods, each lasting decades. The AMO changes sea surface temperatures and, until recently, the AMO was thought to be a naturally-occurring phenomenon of the climate system.

The results build upon research that indicates that AMO fluctuations are linked to changes in aerosol concentrations in the atmosphere. Certain particles or aerosols in the atmosphere, such as those formed from industrial sulphur emissions or from volcanic activity, can scatter sunlight and increase the reflectiveness of clouds. Both processes reduce the amount of sunlight reaching the ocean, lower sea surface temperature and limit photosynthesis of algae, with the overall effect of reducing the coral growth rate. Algae live with the coral, providing them with energy.

Patterns of coral growth in the late 19th and early 20th century were most likely influenced by volcanic activity, whereas lower sea surface temperatures in the Caribbean from 1960 to 1970 were probably caused by emissions from increased industrial activity after the Second World War, mainly in North America and, to a lesser extent, in Central and South America. When policies were put in place to curb industrial emissions around 1970, aerosol concentrations fell and sea surface temperatures rose faster than would have been expected from greenhouse gas emissions alone.

In conclusion, the study found that changes in coral growth rates were strongly related to concentrations of aerosols in the atmosphere. This implies that coral reefs will not only be disturbed by higher carbon dioxide emissions and climate change in the future, but will also be affected by regional levels of aerosols which result from increased industrialisation in some countries or pollution-reduction measures in others.